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account the exactness of the constants of precession and nutation), and, in consequence, the period between 304 and 306 days.

And if we cannot consider the Earth a solid body, the diurnal nutation, of which the period is half a sidereal day, certainly exists.

I estimate its coefficient to be twice as great as that of the initial nutation. It is, then, a new correction to be applied to the observations, if we will be sure of the hundredth of a second of arc.

And then, can we even be sure?

Brussels: July 5, 1890.

Preliminary Note on the Duplicity of α Lyræ.

By A. Fowler.

(*Communicated by Professor J. Norman Lockyer, F.R.S.*)

A photographic study of stellar spectra has recently been commenced at Kensington, under the direction of Professor Lockyer, and one of the first results is the discovery that *α Lyræ* is a binary of the *β Aurigæ* and *ζ Ursæ Majoris* type. The principles of the method have already been fully stated by Professor Pickering (*Monthly Notices*, vol. L, p. 296), but it may be remarked that the evidence of duplicity depends upon the fact that when both components are travelling in opposite directions in the line of sight, the lines of the spectrum which are common will appear double, the spectrum of one being displaced towards the red and the other towards the violet. When the components are moving at right angles to the line of sight, the lines will be single. During a whole period, therefore, a given line will first appear single, let us say, then it will gradually double until a maximum is reached; it will then narrow and become single, widen to another maximum and again appear single.

In the spectrum of *α Lyræ* the principal lines are those of hydrogen, but these do not show the duplication because the separation is not greater than the thickness of the lines. A variation in width, however, amounting almost to doubling in the more refrangible lines, is very obvious. Next to the hydrogen lines the K line is strongest, and this is sufficiently fine and distinct to render the detection of duplication quite easy. The remaining lines are very faint and their duplication is not very apparent. They are only seen to be double in two or three photographs. Fourteen photographs have already been obtained, dating from October 3 to November 4, but, owing to unfavourable weather, there are long breaks in the series. There are sufficient data, however, to enable a provisional period of revolution and the probable form of the orbit to be determined.

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The following table summarises the results so far obtained, the second column giving the separation of the K lines in tenth-metres, and the third the corresponding relative velocity of the two components in the line of sight:—

Date.		Separation of K Lines.	Relative Velocity in the Line of Sight.
Oct. 3,	9 P.M.	3·8	180 miles per second.
„ 8,	8 „	7·8	370 „ „
„ 9,	7 „	4·9	232 „ „
„ 10,	7.20 P.M.	5·5	260 „ „
„ 11,	8.30 „	4·6	218 „ „
„ 12,	8.15 „	6·2	294 „ „
„ 14,	10 „	5·5	260 „ „
„ 17,	10 „	0·0	
„ 27,	8 „	2·3	109 „ „
„ 28,	6.30 „	0·0	
Nov. 1,	8 „	0·0	
„ 1,	8.30 „	2·3	109 „ „
„ 1,	10 „	3·8	180 „ „
„ 4,	9 „	0·0	

A discussion of these data shows that they are all fairly well satisfied by assuming a circular orbit, the plane of which almost passes through the Sun, with a period of revolution of about 24·68 hours. This is best seen when the results are plotted graphically, the variations being represented by the curve of sines. In the accompanying diagram the curve represents the variations in the distance between the K lines assuming the orbit and period to be as stated, and the dots show the actual results deduced from the photographs, the maximum separation being taken as 10 units. It will be seen that practically every dot falls in its proper place on the curve, the slight discrepancies being within the limits of error in measurement.

In the case of ζ *Ursæ Majoris* Professor Pickering found a period of about 52 days, with a maximum relative velocity of 100 miles per second, and for β *Aurigæ* a period of four days with a maximum velocity of about 150 miles per second. Vogel has further discovered by the photographic method that *Spica* is accompanied by a dim companion which completes a revolution in about 4 days, the diameter of the orbit being 6 millions of miles, and the orbital velocity about 50 miles per second. In the case of *a Lyræ*, as already stated, I have found the period to be probably about 24·68 hours, and the maximum relative velocity about 370 miles per second. This period is remarkably short, but it does not seem inconsistent with the great velocity indicated by the photograph of October 8, and is partially confirmed by

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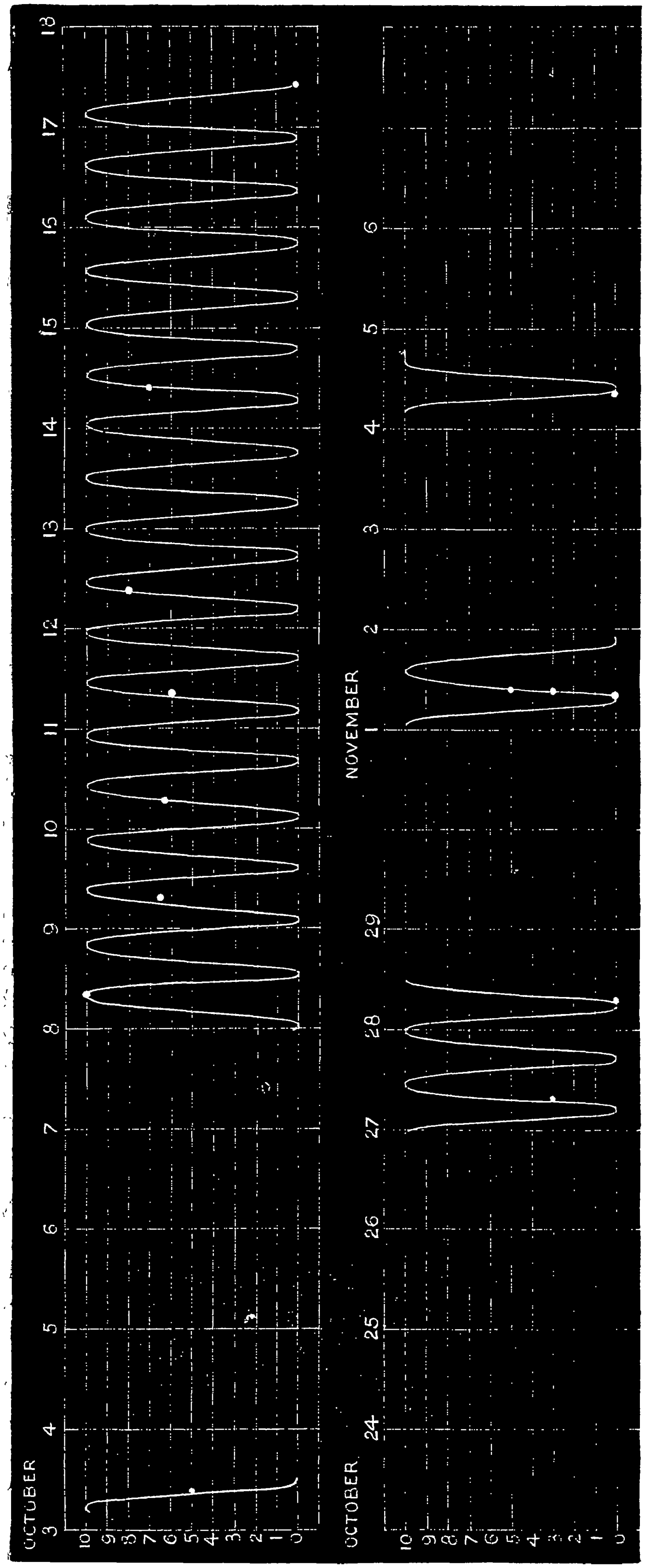

Diagram showing the variations in the separation of the K lines in the spectrum of *α Lyræ*.

(The maximum separation is taken as 10 units.)

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the three photographs of November 1, taken at short intervals. The doubling of the line takes place so quickly that it is difficult to say when it is absolutely single, and hence the minima recorded in the table are only approximate.

It seems fair to assume that 370 miles per second is about the maximum relative orbital velocity, and this gives a little over five millions of miles as the distance between the components. The total mass will therefore be about 22½ times that of the Sun, and as there is no appreciable difference in the intensity of the K lines, or of the hydrogen lines as far as can be estimated from their partial separation, the masses of the components are probably about equal. These values will, of course, require modification if the plane of the orbit does not pass through the Sun. They must not yet be regarded as final, in consequence of the absence of a series of photographs taken at short intervals. Such a series will be obtained as soon as possible; they were not taken in the first instance because it was not suspected that the period was so short. Unfavourable weather has since prevented this being done, and I have taken this opportunity of bringing my results before the Society in the hope that some other observer with better atmospheric conditions may be induced to take up the question.

The mean value of the parallax of *α Lyræ*, as determined by the Struves, Peters, and others is 0″·16, and if we take this as correct, the angular distance between the components at the elongations would be 0″·008. If Elkin's value (0″·034 ± 0·045) be taken, the angle will be very much less, and it is not likely, therefore, that the components will ever be separated by a telescope.

The instrument employed in the investigation was the 10-inch refractor belonging to the Royal College of Science, with two prisms of 7½° each in front of the object-glass. The length of the spectrum from F to K is about an inch and a half, and the maximum separation of the K lines in *α Lyræ* $\frac{1}{50}$th of an inch, or 35″. The exposure was generally a quarter of an hour.

I have to express my obligation to Messrs. Rogers and Baxandall for assistance in taking the photographs.

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On the Variation of the Spectra of R Coronæ and R Scuti, and on the Spectra of R Aurigæ and R Andromedæ. By the Rev. T. E. Espin, B.A.

R Coronæ.—The observations of this star show a curious change of spectrum. Throughout the observations the star was examined on each night with different spectroscopes, and, beginning with feeble dispersion, the examination was continued till the highest dispersion the star would bear was reached.